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RAIN GAUGE EXPOSURE IN THE TRANSVAAL.

By R. T. A. Innes,
Director of the Transvaal Meteorological Department.

One of the standard 5-inch rain gauges at the Johannesburg Observatory is situated on the summit of the Witwatersrand ridge and another in the valley to the north, but only 200 yards or so distant.* The summit gauge always receives less rain than the valley gauge, and it was determined to find out what the effect of a wind-shield on a gauge on the summit would be. Dr. Shaw sent out a wind-shield 18 inches in diameter, and this was put on another gauge erected on the summit. These two gauges have always received the same amount of rainfall, as the accompanying Table which follows show. The photographs on the next page show the rain gauges on the summit. The rain gauge in the foreground is an $11\frac{1}{4}$-inch Halliwell recorder. The first photograph (Fig. 1) shows the ordinary method of mounting rain gauges formerly in use in this Colony; the rain gauge on the right hand shows the wind-shield. In the second photograph (Fig. 2), the rain gauge with the wind-shield is replaced by one mounted in the new style, which is now used. The earlier iron tripod is replaced by a galvanized iron tube, which is filled with soil and the gauge packed in it. The tube stand is firmer and the gauge itself is not so liable to damage by cattle. As in the other colonies of South Africa, all the gauges have their rims 4 feet above ground.

I add a second table giving a comparison of records obtained with a 5-inch standard gauge on a tripod and an 8-inch gauge on a wooden stand at Heidelberg in this Colony. The gauges are only a few feet apart and have an identical exposure. Slight changes in their relative positions have been made on two occasions. The advantage of the more cumbersome and expensive 8-inch gauge is not apparent. The relative capital cost of an 8-inch gauge erected in this Colony is five times that of a 5-inch gauge, so that this question has its importance where funds are limited.

* See this Magazine, Vol. 40 (1905), p. 203.

RAIN GAUGE EXPOSURE IN THE TRANSVAAL.

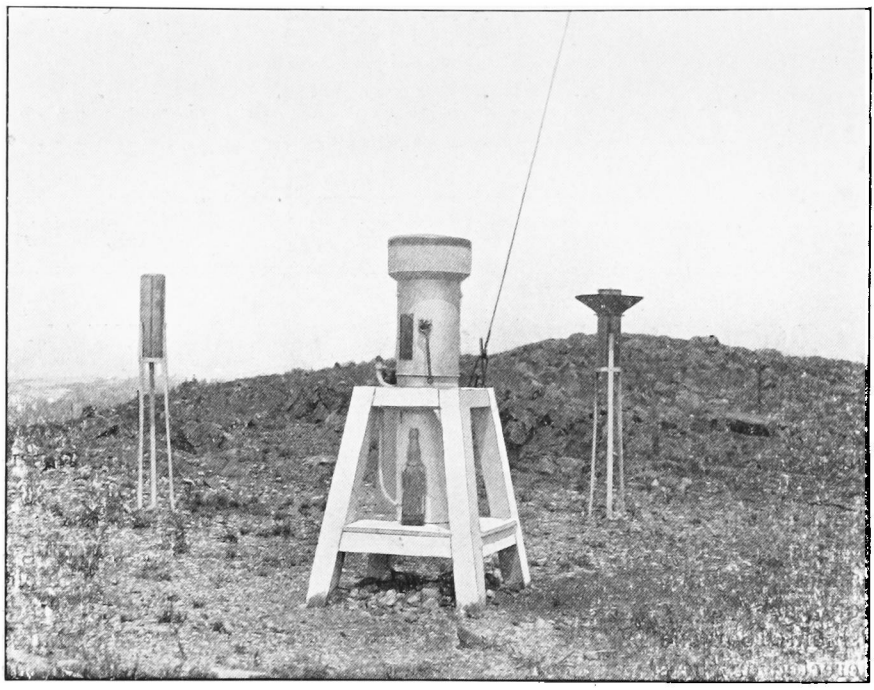


FIG. 1.

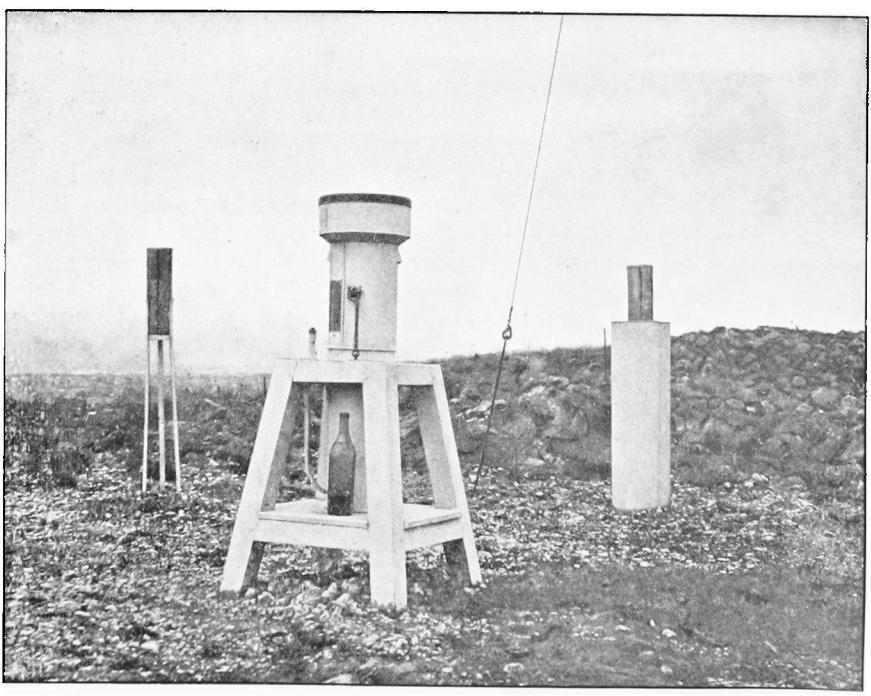


FIG. 2.

Rain Gauges at Observatory, Johannesburg * (*all 5 in. gauges*).

	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	Jun.	TOTAL.
1905-6.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.
Summit.....	...	·06	·23	·85	6·04	3·99	3·81	8·54	3·39	·88	·11	...	27·90
Summit (with wind shield).....	...				5·88	3·98	3·80	8·56	3·39	·88	·12	...	—
Valley	...	·08	·29	·92	6·76	4·52	4·04	9·00	3·71	·95	·13	...	30·40
1906-7.													
Summit.....	...	...	·51	4·97	5·34	4·59							—
Summit (with wind shield).....	...	...	·55	4·97	5·08	4·52							—
Valley	...	...	·55	5·31	5·69	4·88							—

*Rain Gauges at Heidelberg, Transvaal.**

	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	Jun.	TOTAL.
1904-5.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.
8 in. gauge..	...	·06	·20	1·56	6·45	3·27	5·79	5·97	3·01	2·26	·28	...	28·85
5 in. gauge..	...	·06	·20	1·54	6·50	3·30	5·83	5·91	2·97	2·27	·29	...	28·87
1905-6.													
8 in. gauge..	...	·28	·58	·27	6·70	4·99	1·37	5·93	3·40	·71	·19	...	24·42
5 in. gauge..	...	·29	·55	·27	6·95	4·98	1·34	5·93	3·38	·71	·17	...	24·57

* The meteorological year in the Transvaal is reckoned from July to June.

THE BRITISH WEATHER REPORTS.

WITH the beginning of the present year various changes appeared in the Weather Reports issued by the Meteorological Office, which cannot fail to increase their utility to the student as well as to the practical man who has learned how to apply the facts collected and published at the public expense to his own advantage.

We propose here to describe briefly the Daily, Weekly, and Monthly Weather Reports, in their present form, hoping that the public interested in Meteorology may thus be helped to realize more fully than we fear they now do, the completeness and promptitude with which this national work is carried on.

The *Daily Weather Report* is a four-page quarto sheet, issued daily at 2 p.m., after which hour it may be purchased for one penny at the Meteorological Office, 63, Victoria Street, or at the bookstalls in the railway stations at Victoria, Charing Cross, King's Cross, St. Pancras and Euston. We do not remember that we have ever had the *Daily Weather Report* thrust upon our attention at any of the railway stations in question; but at least it may be had there for the asking, which is more, we doubt, than can be said for this Magazine. The *Daily Weather Report* is sent post free to any address for

£1 per annum, and is usually delivered in London between 4 and 5 p.m.

The front page of the Report is occupied with observations of barometer, thermometer, wind, and weather, on the previous evening and on the morning of the day of publication, together with the maximum and minimum temperatures, weather, sunshine, and rainfall at 27 stations in the British Isles, at 31 stations on the continent of Europe, and at 6 in the islands of the North Atlantic, 64 stations altogether.

The last page of the Report contains explanatory notes for the first page, and a quantity of additional information, including figures for the previous day at 24 places in England and Wales, chiefly health resorts, and at 19 foreign stations, going as far afield as St. Petersburg, Malta, Algiers and Madeira. There is also a space neatly ruled off for "Wireless telegrams from ships of H.M. Navy," and this will no doubt be filled in the future, though so far no wireless messages have appeared.

The two inner pages of the Report are devoted to maps, notes, and forecasts. The first map has been extended beyond the limits imposed in previous years, so that now it includes the whole of Western Europe and a strip of the North Atlantic, which allows Iceland on the north, and the Azores on the south, to appear in their proper positions. Observations from the Azores have appeared in the Report for some time, but the inclusion of the data from Iceland and the Färoes is a triumph of the current year, and a most valuable result of the new Iceland cable. The Azores are separated from Europe by too great an extent of sea to allow the data to be used in drawing the isobars which depict the daily distribution of pressure, but Iceland is brought so near to Britain by the convenient stepping stones of Färoe and Shetland, that we now find on the daily weather chart a close approximation to the state of things in the great cyclone track that runs from south-west to north-east, just north of Scotland, and controls our weather to a great extent. It is too soon yet to say how far the new data will increase the accuracy of the forecasts; but they certainly improve the basis on which the forecasts are made. One of the most impressive results is the emphasis with which the new chart expresses the range of pressure that may be experienced. For example, the chart of Wednesday, 20th February, shows a depression over the south of Norway, with a minimum reading of 27·65 in., and a high-pressure area over Portugal with 30·44 in., the total range of pressure in 1400 miles being 2·79 in., or within a quarter of an inch of three inches. The steep gradients and the slow movement of this storm centre shown by the comparison of the charts for several successive days, explain the furious force and the extraordinarily long continuance of the gale which wrecked the Great Eastern Railway steamer *Berlin*, off the Hook of Holland, on the morning of the 21st, and postponed the rescue of the last surviving passengers for 36 hours.

A second large map shows the 8 a.m. distribution of temperature and weather, and small maps show the conditions at 8 a.m. and 6 p.m. on the previous day. The forecast districts are shown on a small map and the storm signals which were flying at the time of publication are indicated on this map. It is a significant tribute to the advance of geographical education that so much important information is presented by a government institution in a cartographic form without the use of words.

The *Weekly Weather Report* is a quarto document of 8 pages, price 6d., or post-free for a year £1 10s., and is issued on the Thursday of the week following that to which it refers. This Report is now in its thirtieth year, but the current volume inaugurates a series of improvements which greatly add to its value. The first page consists of general remarks on the week, with notes on the season and on the past four seasons, the elements referred to being weather, temperature, mean temperature of the sea, rainfall, bright sunshine, barometer and wind. Warmth for each of the twelve forecasting districts is characterised in a tabular summary as Very Unusual, Unusual, Moderate, Deficient, Very Deficient; rainfall similarly as Light, Moderate, Heavy; sunshine as Scanty, Moderate, Abundant. The summary of the thirteen weeks of winter in each of the 12 divisions is given in the form "Rainfall 4*2" where the heavy figure is the number of weeks of heavy rain, the light figure the number of weeks of light rain, the missing weeks representing the number with moderate rain. The definition of the characteristic terms must represent a great deal of thought and calculation. The week's warmth is called "unusual" or "deficient" if it is so much above or below the average for the time of year that in the long run it is likely to occur for that week only once in three years, and "very" is prefixed if it is likely to occur for that week only once in twelve years. Otherwise it is called moderate. Exactly similar definitions are assigned to the terms used for rainfall and sunshine, the whole system being based on the principle of the relative frequency of the values which occur. The idea seems to us a happy one, as it facilitates the comparison of different periods or seasons over considerable areas.

The second page gives for the week, the season and the year, so far as the latter have advanced, the temperature, accumulated number of day-degrees, rainfall and sunshine of each of the twelve divisions; the figures for each of the stations used to obtain the means (90 in all) being given on the third page. Some of the records are contributed by the Royal Meteorological Society and others by the Scottish Meteorological Society, these being duly distinguished from the records of the official stations.

The fourth page contains two Tables, one of grass minimum temperatures and of soil temperatures at depths of 1 foot and 4 feet; the other the highest, lowest and mean temperature of the sea taken twice daily by the coastguards at 21 stations round the British Isles.

Local circumstances make this Table of somewhat unequal value, but it at least calls attention to the importance of considering the sea as well as the land surface in the study of atmospheric conditions.

The remainder of the Report is occupied by three maps for each of the seven days of the week, giving respectively the temperature and weather at 8 a m., the barometer and wind for 8 a.m. and 6 p.m. They are, in fact, a revised and reduced copy of the maps published in the *Daily Weather Report*. Brief explanatory remarks on the weather, temperature, wind and barometer for each day are added.

Finally, there is a summary of the week's observations on temperature, humidity and wind-velocity in the upper air, as ascertained by the ascent of kites or balloons at various stations, especially Brighton, Pyrton Hill on the northern slopes of the Chilterns, Ditcham Park on the South Downs and sometimes the Manchester University station in Derbyshire.

For many years it was the custom to issue a Monthly Supplement to the *Weekly Weather Report*, but with the first month of 1907 this has assumed the more elaborate form of a *Monthly Weather Report*, consisting of 8 quarto pages, to be published before the end of the next following month, and sold at 6d. per copy or 6s. 6d. per annum post free.

The first page gives a summary of the result of observations for the month, with special reference to pressure, the tracks of depressions, the occurrence of anticyclones, wind, temperature, rainfall, sunshine and observations in the upper air. The next five pages are devoted to a very complete summary of the observations at 123 stations in the British Isles and less complete statistics for 47 more. The seventh page contains notes on the statistical Tables and special information regarding special phenomena; thus in the Report for January there is a discussion of the remarkable high-pressure system which prevailed over northern Europe from the 20th to the 26th.

The last page is occupied by four maps expressing in considerable detail the average or general conditions of the month. The first deals with pressure and wind, showing the average for the particular month and the average for that month for 35 years. The second map shows the movements of the barometric depressions for the month, the tracks of each cyclone joining the positions of the centre at 8 a.m. and 6 p.m. on the days of its existence. The third map shows the mean temperature of the month by isotherms drawn for each degree. The fourth map represents the distribution of rainfall for the month and is a new departure in so far as it is prepared by the British Rainfall Organization from about 700 monthly returns. The large number of observations makes it possible to draw lines showing the areas with less than an inch, between 1 and 2 inches, between 2 and 3, between 3 and 4, between 4 and 6, between 6 and 8, between 8 and 10 and over 10 inches; and as each succeed-

ing line is made thicker than the line of lower value the gradation of rainfall is clearly shown. It is, we are sure, a pleasure to all the unofficial observers of rainfall to know that their work is accepted by the Meteorological Office as of public utility, and the full title of the Monthly Weather Report recognizes the voluntary assistance in its wording—"Monthly Weather Report of the Meteorological Office. Summary of Observations compiled from the returns of official stations and volunteer Observers in the United Kingdom, with a Chart contributed by the British Rainfall Organization. Issued by the Authority of the Meteorological Committee." Such co-operation between the various meteorological agencies in the country cannot fail to have a stimulating effect on the advancement and the wider understanding of meteorology.

QUALITATIVE ANALYSIS OF CURVE DIAGRAMS.

By WILHELM KREBS, Hamburg.

THE following statements show a simple method for getting numerical values from the comparison of curve diagrams, which I have also applied to other statistical investigations. It deals only with the general direction of the oscillations, *i.e.*, whether the curve is rising or falling, and can therefore be said to be a qualitative analysis of such diagrams. It would, if applied to the "barometric see-saw," enable one to get numerical values for drawing "isophasms" of pressure and for supplying the place of such doubtful signs as +?, —?, ± and ±?.

I choose another actual example as an illustration.

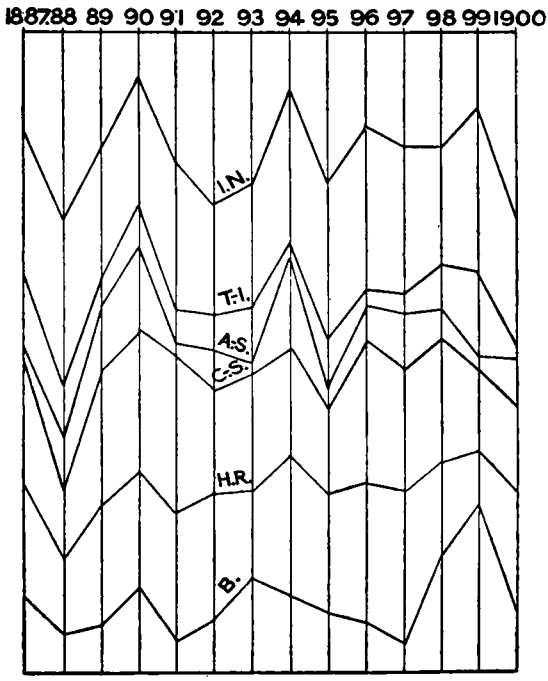
In the following, diagrams are compared from 1887 to 1900.

I.—The mean oscillation of the sea-level of the Baltic on the Swedish shores (B.), after Rosén;

II.—Five other oscillations regarding the quantities of heat in the North Sea near Horns Reef (H.R.), the differences of air-pressure between Copenhagen and Stykkisholm, Iceland (C.S.), between the Azores and Stykkisholm (A.S.), between Toronto and Ivigtut, Greenland (T.I.), and the quantities of Arctic ice near Newfoundland (I.N.), after Meinardus.

The *qualitative analysis* is given in extenso here :—

	1887—'88	— '89	— '90	— '91	— '92	— '93	— '94	— '95	— '96	— '97	— '98	— '99	—1900
B.	down	up	up	down	up	up	down	down	down	down	up	up	down
H.R.	d.	u.	u.	d.	u.	u.	u.	d.	u.	d.	u.	u.	d.
C.S.	d.	u.	u.	d.	d.	u.	u.	d.	u.	d.	u.	d.	d.
A.S.	d.	u.	u.	d.	d.	d.	u.	d.	u.	d.	u.	d.	d.
T.I.	d.	u.	u.	d.	d.	u.	u.	d.	u.	d.	u.	d.	d.
I.N.	d.	u.	u.	d.	d.	u.	u.	d.	u.	d.	0	u.	d.



Agreements with H.R.

	Number			%
B.	11	: 13	=	85
C.S. ...	11	: 13	=	85
A.S. ...	10	: 13	=	77
T.I. ...	11	: 13	=	85
I.N. ...	11.5	: 13	=	89

1. The oscillations of water-temperature near Horns Reef (H.R.) show an important accordance (85%) with those of the Baltic sea-level (B.)

2. They show the same accordance (85%) with the differences of pressure for Toronto-Ivigtut (T.I.) and Copenhagen-Stykkisholm (C.S.)

3. They show a less agreement (77%) with the differences of pressure Azores-Stykkisholm (A.S.)

4. They show a very important agreement (89%) with the oscillations of Arctic ice near Newfoundland (I.N.)

The following conclusions seem to be justified :—

The water-temperature near Horns Reef, the sea-level of the Baltic, and the quantities of Arctic ice near Newfoundland, depend in a high degree on the same causes (1, 4).

The mean atmospheric circulation over the northern Atlantic, especially in the winter half of the year, forms an important part of these causes (2).

It seems possible that the temperature of the eastern part of the North Sea is changed indirectly by the circulation causing the colder surface-water of the Baltic (mean difference from the surface temperature of the North Sea, 4·5° F.) to be more or less effective in cooling the surface of the North Sea.

RAIN-MAKING EXPERIMENTS IN THE KLONDIKE.

WE have pleasure in reprinting from *The Times* of February 11th the following statement as to the "rain-making" experiments referred to in Vol. **41**, p. 115 :—

Owing to the scarcity of water for hydraulic mining in the Klondike district, the Government of Yukon Territory and a number of the largest mineowners and operators made, as reported some time ago in *The Times*, a contract with Mr. C. M. Hatfield, of Los Angeles, who had made many "rain-making" experiments in the arid parts of California. If he produced "a sufficient rainfall to ensure, as far as an ample rainfall would, a successful and prosperous summer in the placer mining industry," the fact to be determined by a board representing the various parties to the contract, he was to receive $5,000 from the Government and $5,000 from the miners; otherwise he was to receive the travelling and living expenses of himself and his assistant. The Commissioner administering the territory now reports that Mr. Hatfield "commenced his demonstrations on June 11th, on a high eminence called the 'Dome,' about 80 miles from Dawson. On Hunker, Sulphur, Gold Run and Dominion creeks the rainfall for June was above the average, but on Bonanza and Eldorado it was below normal. During the early part of July there was no increase over the average of former years. Accordingly, at a meeting of the aforesaid board, held at Dawson on July 23rd, it was decided that 'in the opinion of this committee the contract entered into on July [*sic.*] 10th, 1905, has not been carried out, and that Mr. Hatfield be notified that his contract is terminated.' A copy of this decision was immediately sent to Mr. Hatfield, who thereupon desisted from further experiments. The Government of the Yukon Territory paid $1,153.05 to Mr. Hatfield in full settlement of its liability under said contract." The Commissioner also reports that agriculture is developing in the territory, and regulations have been made under which homestead land can be acquired on liberal conditions by *bonâ fide* settlers. Last summer enough gronnd was brought under cultivation in the Dawson district practically to supply the local demand for vegetables, and the Commissioner expects a large increase in the cultivated area this year.

WEATHER RECORDING.

BY F. DRUCE.

FROM time to time there have appeared in the pages of this Magazine notes on the states of the sky and atmosphere as precursors of weather change.

There is, probably, no student of meteorology but has felt the great difficulty there is in describing adequately in his register the daily phenomena so far as they are not recorded instrumentally.

Some, *e.g.*, wind velocity and cloudiness, are referred to scales and notations—and this is so far satisfactory,—but there are many aspects of sky and atmosphere which cannot be thus dealt with, and are very difficult of description. In proof of this get a number of persons to write down their impressions of the weather of a particular day, and it is a safe assumption that their accounts will vary materially, not necessarily through inaccuracy of observation or the personal equation, but through the inadequacy of means of expression. The whole question is of little importance, no doubt, to a forecaster in a central office receiving telegrams from widely scattered districts,—it rather appeals to the "solitary observer" who is concerned to keep as accurate a register as possible, and one that will be of use, on reference, for forecasting purposes, both to himself and others.

To take a few instances :—(i.) The sky on a hot morning in late spring or summer is clear, except for a few small patches of cirro-cumulus cloud, the atmosphere is very hazy, and the wind is very light, from E.S.E. ; (ii.) The sky (again in summer) is quite covered with cirro-stratus cloud, which gradually assumes the appearance of fine net or gauze, while the atmosphere becomes thicker and thicker, not with fog or mist, but (if the expression may be used) with *damp*, the wind is E.N.E. ; (iii.) The sky is, again, overcast (with cloud much lower in level than in No. 2) and has the appearance of being underlaid with smoke, the wind is W.N.W. ; (iv.) The atmosphere is exceedingly clear in late spring, and the sky partly covered with small cumulus clouds, with hard edges, the wind is N.W. These instances, respectively, may be taken as fairly safe indications of (i.) a late afternoon thunderstorm with wind veering to S.W. ; (ii.) a steady persistent fall of rain, perhaps of an inch or more ; (iii.) intermittent drizzle or rain of little intensity, and (iv.) a backing of wind to S.W. and a gale and rain ; but although the observer has in this way done his best to record the prognostics, (and following weather) and he himself might be able to recognize the former, when recurring, with the recorded descriptions, it is doubtful whether another person taking up the register would gather at all clearly what was meant.

The matter is difficult, and it is not easy to point out any very practicable means of improvement. The connection of meteorology with the affairs of everyday life is, however, so obvious, that no apology should be needed for suggesting that, so far as the observer himself is concerned, a careful diary of his doings side by side with the weather record is of considerable use. The letter of Mr. Bonacina (Vol. **41**, p. 192) provides an instance of this. In it he describes the state of the sky and the following weather near Sevenoaks, on November 3rd last. The present writer, who was on the other side of London on that day, on reading the letter, referred to his diary, and the events there recorded brought clearly to his recollection the state of the sky, the description of which in his

weather register, as a matter of fact, corresponded closely with that given by Mr. Bonacina.

A valuable aid to making an observer's record intelligible to others is to be found in photography—though it must be admitted that with the exception possibly of No. 4, the camera would have been useless in the instances given above. The importance of photography in this connection has already been pointed out in these pages (*e.g.*, Vol. **38**, p. 80), and satisfactory pictures of many cloud forms can be made and annexed to the record, but, of course, the "general look" of the weather and "state of the atmosphere" cannot be recorded in this way. It seems that the best hope of improvement lies in increased care and intelligence, both in observing and in recording what is observed.

ROYAL METEOROLOGICAL SOCIETY.

THE monthly meeting of this Society was held on Wednesday evening, February 20th, at the Institution of Civil Engineers, Great George Street, Westminster, Dr. H. R. Mill, President, in the chair.

Mr. Edward Mawley read his "Report on the Phenological Observations" made during 1906 by observers in various parts of the British Isles. The most noteworthy features of the weather of the phenological year ending November, 1906, as affecting vegetation, were the dry period lasting from the beginning of June until the end of September, and the great heat and dryness of the air during the last few days in August and the first few days in September. Wild plants came into flower in advance of their usual dates until about the middle of April, after which time they were late as a rule to about the same extent. Such early spring migrants as the swallow, cuckoo, and nightingale, reached these Islands somewhat behind their average dates. The only deficient farm crop, taking the country as a whole, was that of hay, all the others being more or less over average. The yield of apples was about average in all but the north of England and in Scotland, where there was a very scanty crop. Pears and plums were everywhere very deficient, whereas all the small fruits yielded moderately well. As regards the farm crops, the past year proved even more bountiful than 1905.

Mr. H. Mellish, Mr. J. E. Clark, Mr. F. C. Bayard, Mr. J. Hopkinson, Mr. W. W. Bryant and the President took part in the discussion, and Mr. Mawley replied.

Mr. R. Inwards read a paper on "The Metric System in Meteorology." He stated that it was not his intention to discuss the general question of the advantages of the metric system over that in use by Britain and her Colonies and the United States of America, but to confine his remarks to the manifest advisability of all the meteorological observers upon the globe adopting some uniform system.

He then proceeded to show by a map how many countries have adopted the metric system in meteorology, and how many use the non-metric. He concluded by saying: "With confident expectation we may, I think, look forward to the time when the whole world will have but one system of meteorological calculation, and as the matter of reconstruction or alteration of some of the standards, units or zeros is now 'in the air,' it would give a good opportunity, if changes must be made, to adopt in England and America the same system which has been for so long a time in use on the Continent of Europe and over a great portion of the land surface of our planet."

In the discussion on this paper, Mr. H. Mellish, Mr. W. H. Dines, Mr. R. H. Curtis, Mr. W. W. Bryant, Mr. F. C. Bayard, Mr. W. Marriott and the President took part, and the general feeling appeared to be unfavourable to the adoption of the metric system by British meteorologists.

Mr. J. L. Adlercron, Mr. G. T. Derry, Mr. W. H. M. Jones, Capt. G. M. Keane, R.N., Mr. J. McEwan, Mr. A. Mudd, Mr. R. Nursey and Mr. A. B. Ogden were elected Fellows of the Society.

A RELATION BETWEEN RAINFALL AT YORK AND SOLAR CYCLES.*

By J. Edmund Clark, B.Sc.

Working with the 89 years of extant records at York (1811 to 1824 and 1831 to 1905), a very obvious contrast was noted between the August rainfall and that of the next two months. August was relatively wetter at times at and following solar quiescence, drier at and following solar activity.

The values for the annual rainfall and for each month were therefore compared with Wolf and Wolfer's sunspot values. Three years were taken about each of the six maxima and minima from 1831 to 1902, or 18 in all at each. The annual values showed 425·73 in. for the latter and 475·73 in., or 12 per cent. more, for the former. *Every* minimum, except that of 1879, produced less rain than the succeeding maximum. Nine of the months contributed to this; in August alone was there marked excess.

For the 18 years at minima the August rainfall was 59·78 in.; at maxima, 38·02 in., or an excess of 36½ per cent. The values for September were 45·19 in. and 30·53 in.; for October, 49·61 in. and 35·62 in.

Again, for August and October the contrast is true of *each* decade, comparing the fall at each solar minimum with the following maximum. It is true, also, of the first four in September by nearly two to one. In the sixth the values are equal. That they are reversed

* Abstract of Paper read at the Meeting of the British Association at York, 1906.

in the fifth is not surprising, as September in the seventies gave a mean of 3·36 in., against 1·89 in. for the other 79 years.

We can accentuate the above contrast by taking the difference between the mean of September and October $(\frac{S+O}{2})$ and August (A); that is, by using the value $\frac{S+O}{2} - A$. The actual mean result is $-0{\cdot}26$ in.

The resulting curve from taking the 3-bloxamed values year by year is strikingly analogous to the sunspot curve.

These year-by-year values were sorted out over a smooth 11-year cycle,* the first year (I.) corresponding to minimum and the sixth (VI.) to maximum sunspots.

This smoothing can be likened to the stretching round an 11-inch cup-rim of six rubber rings, ranging from 9 to 13 inches round, all marked in inches. "I." of each ring comes on "I." of the cup. On "VI." comes the actual year of sunspot maximum, ranging from "IV." to "VII." The rest are stretched or puckered over the values between.

The six sets were then combined and the mean taken for our formula $\frac{S+O}{2} - A$.

The resulting values give an unbroken curve practically identical with the sunspot curve. If the half-periods are taken, each is practically the same. So also if the unbloxamed values are used. This is shown in the subjoined Table.

	I.	II.	III.	IV.	V.	VI.	VII.	VIII	IX.	X.	XI.
1831-1866—3-bloxamed ...	−1·3	−2·0	−1·3	−0·9	+0·1	+0·1	+0·1	+0·2	−0·1	−0·5	−1·2
1867-1905— ,, ...	−1·3	−0·6	−0·2	+0·3	+0·4	+1·0	+1·1	+0·6	+0·7	−0·0	−0·6
1831-1905— ,, ..	−1·3	−1·2	−0·7	−0·2	+0·3	+0·5	+0·6	+0·4	+0·3	−0·3	−0·9
,, un-bloxamed	−1·8	−1·0	−0·7	−0·3	+0·2	+0·6	+0·6	+0·6	+0·3	+0·0	−1·0
1831-1901—Sunspots	6	17	37	62	78	115	86	69	41	25	14

Similar results are found for other British stations examined, including the long-period records from Exeter (87 years), Rothesay (103) and London (106). If the same 70 years are taken, the resemblance is still closer. The minimum at I. occurs even for the longer records. Uppingham also (1736–98) is similar, though the extremes fall at II. and VIII., accentuating the tendency to "lag."

For York rain days $\frac{S+O}{2} - A$. ranges from $-0{\cdot}8$ at I. to $+2{\cdot}2$ days at V. and 1·9 as a "hump" at X. The temperature range is from $-6{\cdot}9°$ at II. to $-9{\cdot}0°$ at V., but the curve is more irregular.

The two 35-year periods also yield similar interesting results. This is more marked when the 11-year cycles are eliminated from the rainfall and sunspot curves.

* See *Symons's Meteorological Magazine*, February, 1904.

Correspondence.

To the Editor of Symons's Meteorological Magazine.

AURORA BOREALIS ON FEBRUARY 9th.

LAST night, after dark, noticing that the northern sky was very much lighter than it ought to have been, I suspected that an aurora was the cause. The early part of the phenomenon was much obscured by fog, but soon after 8 p.m. the fog dispersed, revealing a rather fine display of aurora borealis for the south of England. The arc was broad and extensive, and of varied hues of rose red and gold; the streamers were sharply defined, and extended nearly half way across the firmament, whilst the coruscations were at times quite brilliant. L. C. W. BONACINA.

Clandon, Surrey, February 10th, 1907.

The following notes of the auroral display of February 9th may be of interest.

8.15 p.m.—The aurora appeared.

8.20.—Faint streamers of light, extending up from N. by W. horizon. A large patch of a vivid scarlet colour appeared over the western horizon at an elevation of 35°.

8.35 to 8.45.—The streamers of light replaced by waves or pulsations of light passing across the sky from N. by W.

8.50.—Re-appearance of streamers of light, one of great brilliancy extending from N. and W. horizon, through Cassiopea well towards the zenith Cessation of pulsations of light.

8.55.—Streamers disappear, faint pulsations of light again noticeable, as waves crossing the sky.

The display was followed by the appearance of a bank of black cloud (fog), 10° in elevation, lying off the N. horizon, at times cirrus clouds appeared above lower clouds. D. WILSON-BARKER.

Greenhithe, February, 1907.

AUDIBLE METEORS.

SINCE I wrote the letter published in your February number, I have read Mr. E. Huntley's note in your November number. The meteor he saw on August 7th, 1906, was evidently a Perseid, belonging to the great annual shower of August. Several other bright Perseids were observed at various times and by different persons on the date mentioned. It is in the highest degree probable that the sound heard by Mr. Huntley had no connection whatever with the meteor seen at about the same time. The average heights of the Perseids are from 80 miles at beginning to 54 miles at ending, and sound

reaching us from such objects (even when crossing the zenith of the observer) must necessarily occupy from about $4\frac{1}{2}$ to $6\frac{1}{2}$ minutes in transmission.

Moreover the members of this system do not apparently belong to the detonating class, for they very rarely furnish audible sounds. I cannot recall a single instance of the kind supported on ample evidence—of 2990 Perseids recorded by the writer at Bristol during the years 1869–1906, not one appears to have occasioned a well-marked detonation.

Mr. J. G. Wood seems to be indiscriminately confusing bright meteors with electrical phenomena, sometimes known as "ball-lightning." There is a wide distinction between meteoric fireballs and electrical fireballs. I quite agree with Mr. C. L. Brook's interesting remarks on the subject of audible meteors. There is no question that sounds of various character (heard either instantaneously with or following meteoric outbursts) are frequently attributed to meteors when no real association exists. Some people are so peculiarly sensitive to impressions, imaginary and illusory, that it is quite customary for them to hear a hissing noise as a meteor shoots along the sky. One pretty well known astronomical observer ascribes a detonation to every conspicuous meteor which comes under his notice. On the disappearance of an object he listens attentively for a long time afterwards, and generally hears something within half-an-hour (he lives in a populous city), which he confidently connects with the meteoric explosion. But his conclusions have been proved to be erroneous in several cases where duplicate observations enabled the real paths and distances of the objects to be ascertained.

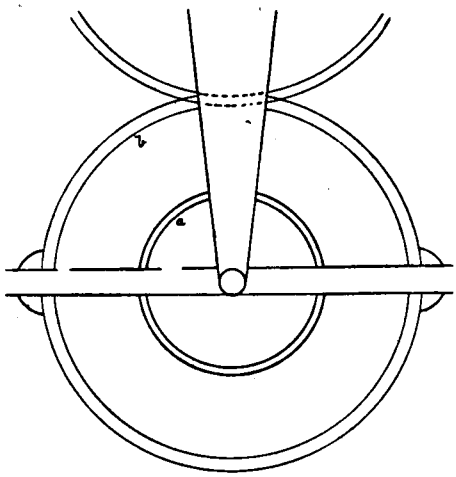
As good typical examples of large and really detonating fireballs, those of November 23rd, 1877, and January 25th, 1894, may be mentioned. But the hissing of *ordinary* meteors and shooting stars, sometimes said to occur simultaneously with their flights across the sky, is an illusion. The laws of acoustics, even if no other negative evidence were available, forbid our entertaining the idea that the sound of meteoric concussions travels with special velocity. It is far easier to believe that observers have made mistakes, and there is an abundance of evidence affording significant indication, if not convincing proof, that this is the correct explanation.

W. F. DENNING.

February 20th, 1907.

SOLAR HALO.

THE sketch shows a solar halo seen from Epsom Downs during the afternoon of February 6th last. The sky at the time of observation was covered with cirro-stratus of varying density, the sun shining through with a pale greyish gold light The inner halo (*a*) was



narrow and of a silver-grey colour, the outer halo (*b*) was brightly prismatic. The partial halo visible at the top of the diagram, cutting the outer one (*b*) was almost comparable with a rainbow in the intensity of its light. A broad bar of a silver-grey colour extended across the sun and halos, being broken only at the top to the left of the sun. Outside the halo (*b*) were circles of light of a pale yellow hue. Upwards towards the zenith there extended a ray of golden light; the halos (*a* and *b*) were invisible through this beam, but the partial halo at the top shone through, although very faintly. The phenomenon varied both in intensity of colour and completeness of outline.

SPENCER C. RUSSELL, F.R.Met.Soc.

Epsom, February 20th, 1907.

SOLAR ACTIVITY AND WEATHER.

IN your January issue (Vol. 41, p. 232), under "The Sunspot Question," a correspondent writes to point out that Professor Bigelow's results, according to a review in the November issue, are at variance with those of certain other investigators.

Professor Bigelow indicates that the solar prominences, not the spots, are the true register of the variable solar activity which synchronizes with weather conditions, and that, whereas the 3-year period in the prominence-frequency is more marked than the 11-year period in accordance with a more strongly-marked 3-year period in the variations of atmospheric pressure and temperature over the Earth's surface, the 11-year period in the frequency of spots is more conspicuous than the 3-year period. It is probably here that the discrepancy referred to by your correspondent arises.

L. C. W. B.

January 24th, 1907.

TROPICAL RAINFALL.

A FACT which came to my knowledge to-day in an official Report from the Estate may be of interest to you. At Ingrugalla Estate, Dolosbagie District, Central Province Ceylon, on December 8th, 1906, 6·37 in. of rain fell between 4.30 and 5.30 p.m. Bridges were carried away and much damage done. N. W. GRIEVE.

Groombridge, Jan. 3rd, 1907.

THE LANDER SELF-RECORDING RAIN GAUGE.

SEVERAL of your readers having gathered a somewhat incorrect impression about the clock from your otherwise very favourable account of my rain gauge in your last issue, perhaps you will kindly allow me to say that the clock and gear is the well-known barograph pattern, by one of the very best makers, and is exactly the same as supplied by a number of well-known makers in their barographs, thermographs, and other self-recording instruments. I have tried a great number of clocks of various patterns, with lever and cylinder escapements, but the one now supplied has proved itself by far the best. If it is possible to get a better one I should be glad to obtain a sample from the makers. Nothing short of a chronograph movement, with delicate temperature compensation, would keep *absolutely accurate* time when exposed out of doors, to temperatures which vary from 20° to 100° F., but such a movement is quite unnecessary and would cost far more than the price of the whole instrument.

I may say that about a dozen recent Kew certificates for my instruments fitted with these clocks state that "clock rate and time scale were found to be satisfactory." A. LANDER.

METEOROLOGICAL NEWS AND NOTES.

MR. A. LAURENCE ROTCH, the well-known founder and Director of Blue Hill Meteorological Observatory in Massachusetts, has been appointed Professor of Meteorology in Harvard University. The Blue Hill observations have been published in the *Annals of the Harvard College Observatory* for many years.

THE ROYAL METEOROLOGICAL SOCIETY at its meeting on Wednesday, 20th March, will be addressed by Major B. F. S. Baden-Powell, in a lecture on "The Exploration of the Air," illustrated by models and lantern slides, and dealing, we understand, with recent advances in the direction of obtaining observations in the free air by means of flying machines. It has been announced that the annual dinner of the Society will be held at the Trocadero Restaurant, on June 18th, and as one of the afternoon meetings of the Society takes place on the following day the opportunity is one likely to attract Fellows living in the country who have few opportunities of meeting each other.

A COURSE OF FIVE LECTURES on Dynamical Meteorology was commenced at University College, Gower Street, by Dr. W. N. Shaw, in his capacity as Reader in Meteorology in the University of London, on Friday, 22nd February. The course, for which no fee is charged, was unfortunately interrupted by the illness of the lecturer, but continues on Fridays, at 5 p.m., after Easter.

TEMPERATURE FOR FEBRUARY, 1907.

STATION.	COUNTY.	Lat. N.	Long. W. [*E.]	Height above Sea. ft.	TEMPERATURE. Max. °	Max. Date.	Min. °	Min. Date.	No. of Nights at or below 32°: Shade.	Grass
		° ′	° ′							
Camden Square	*London*	51 32	0 8	111	52·0	17	23·4	24	15	21
Tenterden	*Kent*	51 4	*0 41	190	53·0	17, 28	21·0	23	16	23
West Dean	*Hampshire*	51 3	1 38	137	51·0	15, 17	15·0	2, 3	17	23
Hartley Wintney	,,	51 18	0 53	222	54·0	18, 28	16·0	2	17	22
Hitchin	*Hertfordshire*	51 57	0 17	238	51·0	17	21·0	8, 23	19	...
Winslow (Addington)	*Buckinghamshr.*	51 58	0 53	309	52·0	17	18·0	2, 23	19	21
Bury St. Edmunds (Westley)	*Suffolk*	52 15	*0 40	226	54·5	28	17·0	8	16	...
Brundall	*Norfolk*	52 37	*1 26	66	54·4	28	20·6	8	17	21
Winterbourne Steepleton	*Dorset*	50 42	2 31	316	50·8	17	18·3	3	16	20
Torquay (Cary Green)	*Devon*	50 28	3 32	12	53·4	9	24·6	24	9	19
Polapit Tamar [Launceston]	,,	50 40	4 22	315	52·6	15	18·1	3	14	23
Bath	*Somerset*	51 23	2 21	67	53·0	19, 27	17·0	3	16	...
Stroud (Upfield)	*Gloucestershire*	51 44	2 13	226	54·0	17	22·0	2, 3	15	...
Church Stretton (Woolstaston)	*Shropshire*	52 35	2 48	800	49·5	27	15·0	23	27	...
Bromsgrove (Stoke Reformatory)	*Worcestershire*	52 19	2 4	225	49·0	15†	13·0	2	...	22
Boston	*Lincolnshire*	52 58	0 1	25	53·0	27	21·0	2	19	...
Worksop (Hodsock Priory)	*Nottinghamshire*	53 22	1 5	56	55·8	15	17·1	3	19	26
Derby (Midland Railway)	*Derbyshire*	52 55	1 28	156	53·0	15‡	16·0	2	20	...
Bolton (Queen's Park)	*Lancashire*	53 35	2 28	390	50·8	15	23·0	2	17	22
Wetherby (Ribston Hall)	*Yorkshire, W.R.*	53 59	1 24	130	...	...	...	...	...	...
Arncliffe Vicarage	,, ,,	54 8	2 6	732	...	...	...	...	...	...
Hull (Pearson Park)	,, *E.R.*	53 45	0 20	6	55·0	15§	19·0	3	15	26
Newcastle (Town Moor)	*Northumberland*	54 59	1 38	201	...	...	...	...	...	...
Borrowdale (Seathwaite)	*Cumberland*	54 30	3 10	423	53·6	27	18·3	1	18	...
Cardiff (Ely)	*Glamorgan*	51 29	3 13	53	...	...	...	...	...	...
Haverfordwest (High Street)	*Pembroke*	51 48	4 58	95	51·8	15	22·2	2	11	14
Aberystwyth (Gogerddan)	*Cardigan*	52 26	4 1	83	52·0	27	18·0	1, 2	...	...
Llandudno	*Carnarvon*	53 20	3 50	72	52·0	15, 19	28·2	3	8	...
Cargen [Dumfries]	*Kirkcudbright*	55 2	3 37	80	52·0	25	15·0	1, 6	17	...
Lilliesleaf (Riddell House)	*Roxburgh*	55 31	2 46	550	55·0	27	16·0	5	22	26
Edinburgh (Royal Observy.)	*Midlothian*	55 55	3 11	442	52·1	27	21·3	1	17	19
Colmonell (Clachanton)	*Ayr*	55 8	4 54	140	54·0	18	19·0	4	13	...
Glasgow (Queen's Park)	*Renfrew*	55 53	4 18	144	51·0	27	20·0	5	16	24
Tighnabruaich	*Argyll*	55 55	5 14	50	48·0	27	22·0	21, 22	19	20
Mull (Quinish)	,,	56 36	6 13	35	51·0	27	...	...	...	...
Dundee (Eastern Necropolis)	*Forfar*	56 28	2 57	199	55·5	27	19·5	6	17	...
Braemar	*Aberdeen*	57 0	3 24	1114	...	..	...	...	...	...
Aberdeen (Cranford)	,,	57 8	2 7	120	59·0	26	24·0	5, 12	21	...
Cawdor (Budgate)	*Nairn*	57 31	3 57	250	...	...	...	...	...	...
Invergarry	*E. Inverness*	57 4	4 47	130?	...	...	...	...	...	...
Loch Torridon (Bendamph)	*W. Ross*	57 32	5 32	20	...	...	...	...	...	...
Dunrobin Castle	*Sutherland*	57 59	3 56	14	52·0	15	23·0	1	15	..
Castletown	*Caithness*	58 35	3 23	100	50·0	15, 28	23·0	11, 21	23	25
Killarney (District Asylum)	*Kerry*	52 4	9 31	178	59·0	16	27·0	5, 23	...	...
Waterford (Brook Lodge)	*Waterford*	52 15	7 7	104	53·0	17	24·0	22	12	...
Broadford (Hurdlestown)	*Clare*	52 48	8 38	167	50·0	14	24·0	7	15	...
Carlow (Browne's Hill)	*Carlow*	52 50	6 53	291	...	...	...	...	...	...
Dublin (Fitz William Square)	*Dublin*	53 21	6 14	54	55·7	15	28·4	5	14	18
Ballinasloe	*Galway*	53 20	8 15	160	...	...	...	...	...	...
Clifden (Kylemore House)	,,	53 32	9 52	105	...	...	...	...	...	...
Crossmolina (Enniscoe)	*Mayo*	54 4	9 18	74	...	...	...	...	...	...
Seaforde	*Down*	54 19	5 50	180	51.0	15	26·0	5	21	18
Londonderry (Creggan Res.)	*Londonderry*	54 59	7 19	320	...	...	...	...	...	...
Omagh (Edenfel)	*Tyrone*	54 36	7 18	280	52·0	15	25·0	5	16	...

† and 16, 17, 27 ‡ and 27, 28. § and 25, 28

RAINFALL FOR FEBRUARY, 1907.

No. of Nights at or below 32°			RAINFALL OF MONTH.							RAINFALL FROM JAN. 1.				Mean Annual 1870–1899.	STATION.
	Shade.	Grass	Aver. 1870-99.	1907.	Diff. from Av.	% of Av.	Max. in 24 hours.		No. of Days	Aver. 1870-99.	1907.	Diff. from Aver.	% of Av.		
			in.	in.	in.		in.	Date.		in.	in.	in.		in.	
	15	21	1·62	1·17	— ·45	72	·38	10	13	3·51	2·08	— 1·43	59	25·16	Camden Square
	16	23	1·85	1·42	— ·43	77	·42	12	11	4·21	2·42	— 1·79	57	28·36	Tenterden
3	17	23	2·27	1·60	— ·67	70	·51	12	12	4·95	2·45	— 2·50	50	29·93	West Dean
	17	22	2·06	1·50	— ·56	73	·44	19	8	4·45	2·16	— 2·29	49	27·10	Hartley Wintney
23	19	...	1·54	1·22	— ·32	79	·42	12	15	3·35	2·19	— 1·16	65	24·66	Hitchin
23	19	21	1·73	1·11	— ·62	64	·32	12	12	3·78	2·07	— 1·71	55	26·75	Addington
	16	...	1·55	1·53	— ·02	99	·37	10	16	3·25	2·82	— ·43	87	25·39	Westley
	17	21	1·49	1·77	+ ·28	119	·33	12	21	3·16	3·49	+ ·33	110	25·40	Brundall
	16	20	3·11	1·71	—1·40	55	·36	11	13	7·01	3·88	— 3·13	55	39·00	Winterbourne Stpltn
	9	19	2·87	1·53	—1·34	53	·58	11	11	6·06	3·26	— 2·80	54	35·00	Torquay
	14	23	2·84	1·71	—1·13	60	·44	19	16	6·71	4·44	— 2·27	66	38·85	Polapit Tamar
	16	...	2·12	1·26	— ·86	59	·32	12	12	4·64	2·49	— 2·15	54	30·75	Bath
3	15	...	2·13	1·36	— ·77	64	·25	11	14	4·59	2.66	— 1·93	58	29·85	Stroud
	27	...	2·27	1·65	— ·62	73	·35	12	16	5·08	3·41	— 1·67	67	33·04	Woolstaston
	...	22	1·63	·64	— ·99	39	·13	8	10	3·54	1·47	— 2·07	42	24·50	Bromsgrove
	19	...	1·55	1·14	— ·41	74	·50	12	11	3·14	1·92	— 1·22	61	23·30	Boston
	19	26	1·58	1·47	— ·11	93	·47	12	17	3·32	2·22	— 1·10	67	24·70	Hodsock Priory
	20	...	1·66	1·76	+ ·10	106	·38	12	15	3·61	2·91	— ·70	81	26·18	Derby
	17	22	2·67	2·48	— ·19	93	·63	11	13	6·05	4·78	— 1·27	79	42·43	Bolton
	...	...	1·63	1·80	+ ·17	110	·38	12	14	3·52	3·10	— ·42	88	26·96	Ribston Hall
	...	...	4·74	5·58	+ ·84	118	1·87	16	14	11·07	9·04	— 2·03	82	60·96	Arncliffe Vic.
	15	26	1·86	1·54	— ·32	83	·71	12	15	3·66	2·55	— 1·11	70	27·02	Hull
	...	...	1·58	1·25	— ·33	79	·33	12	15	3·54	1·73	— 1·81	49	27·99	Newcastle
	18	...	11·64	8·69	—2·95	75	2·45	16	13	26·35	14·70	—11·65	56	132·68	Seathwaite
	...	...	3·13	1·78	—1·35	57	·50	19	12	6·98	4·57	— 2·41	65	42·81	Cardiff
	11	14	3·70	2·30	—1·40	62	·64	11	14	8·83	4·58	— 4·25	52	47·88	Haverfordwest
2	...	...	3·03	2·62	— ·41	86	·44	11	18	6·90	5·96	— ·94	86	45·41	Gogerddan
	8	...	1·97	1·55	— ·42	79	·37	18	15	4·54	2·97	— 1·57	65	30·98	Llandudno
6	17	...	3·62	2·97	— ·65	82	·84	10	9	8·16	4·99	— 3·17	61	43·43	Cargen
	22	26	2·41	1·09	—1·32	45	·56	19	13	5·01	2·13	— 2·88	43	33·04	Riddell House
	17	19	...	1·01	...	...	·40	19	10	...	1·85	...	...	...	Edinburgh
	13	...	3·67	2·60	—1·07	71	·43	10	10	8·19	5·10	— 3·09	62	44·85	Colmonell
	16	24	2·53	2·68	+ ·15	106	·65	16	13	5·78	4·54	— 1·24	79	35·80	Glasgow
22	19	20	4·57	4·64	+ ·07	102	·70	19	17	10·43	8·74	— 1·69	84	57·90	Tighnabruaich
	...	...	4·50	4·52	+ ·02	100	·66	7	22	10·35	9·11	— 1·24	88	57·53	Quinish
	17	...	2·10	1·00	—1·10	48	·40	19	12	4·20	1·95	— 2·25	46	28·95	Dundee
	...	...	2·70	2·36	— ·34	87	...	...	...	5·61	3·97	— 1·64	71	36·07	Braemar
12	21	...	2·43	1·87	— ·56	77	·36	12	16	4·75	3·76	— ·99	79	33·01	Aberdeen
	...	...	1·86	2·03	+ ·17	109	·66	19	9	4·00	3·73	— ·27	93	29·37	Cawdor
	...	...	4·89	7·07	+2·18	145	1·21	16	13	11·52	13·43	+ 1·91	117	56·00	Invergarry
	...	...	6·77	11·93	+5·16	176	1·09	20	23	15·52	21·41	+ 5·89	138	86·50	Bendamph
	15	..	2·39	3·16	+ ·77	132	1·04	19	11	5·01	7·28	+ 2·27	145	31·60	Dunrobin Castle
21	23	25	...	3·01	...	...	·70	19	21	...	6·90	...	...	...	Castletown
23	...	...	5·44	2·38	—3·06	44	·43	12	19	12·01	4·76	— 7·25	40	58·11	Killarney
	12	...	3·30	1·87	—1·43	57	·59	11	15	7·36	2·66	— 4·70	36	39·30	Waterford
	15	...	2·19	2·21	+ ·02	101	·59	11	15	5·17	3·65	— 1·52	71	33·47	Hurdlestown
	...	...	2·61	...	...	...	...	...	...	5·76	..	...	...	34·44	Carlow
	14	18	1·98	1·30	— ·68	66	·38	11	14	4·14	1·73	— 2·41	42	27·75	Dublin
	...	...	2·48	...	...	...	...	...	...	5·97	...	...	...	37·04	Ballinasloe
	...	...	6·08	4·46	—1·62	73	·72	8	16	13·94	8·29	— 5·65	59	80·23	Kylemore House
	...	...	4·01	3·93	— ·08	98	·37	19	24	9·01	7·23	— 1·78	80	50·50	Enniscoe
	21	18	2·97	2·04	— ·93	69	·45	19	16	6·60	3·43	— 3·17	52	38·61	Seaforde
	...	...	2·73	4·11	+1·38	151	·95	20	20	6·29	7·58	+ 1·29	121	41·20	Londonderry
	16	...	2·49	2·72	+ ·23	109	·35	16	18	5·83	4·97	— ·86	85	37·85	Omagh

SUPPLEMENTARY RAINFALL, FEBRUARY, 1907.

Div.	STATION.	Rain. inches	Div.	STATION.	Rain. inches
II.	Abinger Hall	2·00	XI.	Rhayader, Tyrmynydd	...
,,	Ramsgate, West Cliff Villas	1·26	,,	Lake Vyrnwy	4·41
,,	Hailsham	1·55	,,	Llangyhanfal, Plâs Draw	1·75
,,	Crowborough, Uckfield Lodge	2·23	,,	Criccieth, Talarvor	1·95
,,	Osborne, Newbarn Cottage.	1·37	,,	Llanberis, Pen-y-pass	2·23
,,	Emsworth, Redlands	1·44	,,	Lligwy	1·76
,,	Alton, Ashdell	2·01	,,	Douglas, Woodville	2·59
,,	Newbury, Welford Park	1·70	XII.	Stoneykirk, Ardwell House	1·75
III.	Harrow Weald, Hill House.	1·31	,,	Dalry, The Old Garroch	5·03
,,	Oxford, Magdalen College..	1·04	,,	Langholm, Drove Road	3·28
,,	Bloxham Grove	1·18	,,	Moniaive, Maxwelton House	3·35
,,	Pitsford, Sedgebrook	1·25	XIII.	N. Esk Reservoir [Penicuick]	3·10
,,	Huntingdon, Brampton	1·00	XIV.	Maybole, Knockdon Farm..	2·10
,,	Wisbech, Bank House	1·22	XV.	Campbeltown, Witchburn...	2·75
IV.	Southend Water Works	1·20	,,	Inveraray, Newtown	7·87
,,	Colchester, Lexden	·83	,,	Ballachulish House	9·73
,,	Newport, The Vicarage	1·32	,,	Islay, Eallabus	4·97
,,	Rendlesham	·65	XVI.	Dollar Academy	3·67
,,	Swaffham	1·32	,,	Loch Leven Sluice	2 40
,,	Blakeney	1·35	,,	Balquhidder, Stronvar	7·68
V.	Bishops Cannings	1·24	,,	Perth, Pitcullen House	1·46
,,	Ashburton, Druid House	2·60	,,	Coupar Angus Station	1·26
,,	Okehampton, Oaklands	2·06	,,	Blair Atholl	3·47
,,	Hartland Abbey	1·63	,,	Montrose, Sunnyside Asylum	2·21
,,	Lynmouth, Rock House	2·39	XVII.	Alford, Lynturk Manse	1·61
,,	Probus, Lamellyn	1·81	,,	Keith Station	1·66
,,	Wellington, The Avenue	1·53	XVIII.	N. Uist, Lochmaddy	3·15
,,	North Cadbury Rectory	1·03	,,	Alvey Manse	2·53
VI.	Clifton, Pembroke Road	1·81	,,	Loch Ness, Drumnadrochit.	2·90
,,	Ross, The Graig	·87	,,	Glencarron Lodge	10·02
,,	Shifnal, Hatton Grange	1·06	,,	Fearn, Lower Pitkerrie	1·14
,,	Cheadle, The Heath House.	1·89	XIX.	Invershin	2·66
,,	Blockley, Upton Wold	1·64	,,	Altnaharra	4·40
,,	Coventry, Kingswood	1·04	,,	Bettyhill	2·12
VII.	Market Overton	1·20	,,	Watten Station	1·54
,,	Market Rasen	1·83	XX.	Dunmanway, The Rectory..	3·37
,,	Bawtry, Hesley Hall	1·11	,,	Cork	1·86
VIII.	Neston, Hinderton Lodge...	1·32	,,	Darrynane Abbey	4·04
,,	Southport, Hesketh Park...	1·70	,,	Glenam [Clonmel]	2·02
,,	Chatburn, Middlewood	3·49	,,	Ballingarry, Gurteen	1·79
,,	Cartmel, Flookburgh	2·50	,,	Miltown Malbay	3·99
IX.	Langsett Moor, Up. Midhope	3·57	XXI.	Gorey, Courtown House	1·42
,,	Scarborough, Scalby	1·85	,,	Moynalty, Westland	2·57
,,	Ingleby Greenhow	1·55	,,	Athlone, Twyford	2·38
,,	Mickleton	2·38	,,	Mullingar, Belvedere	2·80
X.	Bardon Mill, Beltingham	1·46	XXII.	Woodlawn	2·84
,,	Ewesley, Fallowlees	2·22	,,	Westport, Murrisk Abbey..	...
,,	Ilderton, Lilburn Cottage...	1·57	,,	Collooney, Markree Obsy..	3·28
,,	Keswick, York Bank	3·46	XXIII.	Enniskillen, Portora	3·07
XI.	Llanfrechfa Grange	2·58	,,	Warrenpoint, Summer Hill.	·78
,,	Treherbert, Tyn-y-waun	4·88	,,	Banbridge, Milltown	1·45
,,	Carmarthen, The Friary	2·74	,,	Belfast, Springfield	2·35
,,	Castle Malgwyn [Llechryd].	1·76	,,	Bushmills, Dundarave	2·64
,,	Plynlimon	5·40	,,	Stewartstown, The Square..	2·95
,,	Tall-y-llyn	1·60	,,	Killybegs	5·66
,,	New Radnor, Ednol	2·57	,,	Horn Head	4·53

METEOROLOGICAL NOTES ON FEBRUARY, 1907.

ABBREVIATIONS.—Bar. for Barometer; Ther. for Thermometer; Temp. for Temperature; Max. for Maximum; Min. for Minimum; T for Thunder; L for Lightning; TS for Thunderstorm; R for Rain; H for Hail; S for Snow.

LONDON, CAMDEN SQUARE.—The first week was dry and frosty, but the anticyclonic conditions gave way on 7th and overcast and damp weather followed without much rise of temp. The second half of the month was milder, with considerable sunshine and, after 20th, no R. Duration of sunshine 53·7* hours and of R 23·4 hours. Mean temp. 37°·8, or 2°·0 below the average.

CROWBOROUGH.—The first 8 days were cold and thaw set in on 9th, but there was another spell of severe frost from 19th to 24th. Mean temp. 37°·5. R ·14 in. below the average of 36 years.

HARTLEY WINTNEY.—Frost and a little fog until 10th, followed by R. The last week was bright and cold. Splendid display of aurora borealis from 9 p.m. till midnight on 9th. Terrible storm of N.E. wind on 19th and 20th. Ozone occurred every day, with a mean of 3·2.

NORTH CADBURY.—A cold and quiet month, closely parallel to those of 1901 and 1902. The R was small, making that of the three winter months far the lowest in 11 years. Vegetation was late and the pond extremely low.

CLIFTON.—The first week was fine and frosty, with N.E. winds; then warmer, with R nearly every day till 21st and S on 19th, 20th and 21st. The last week was dry, with N.W. winds. R ·66 in. below the average.

BOLTON.—A normal month. The first week was cold and dull but fair and no R fell till 8th. The temp. was above the average from 8th to 19th, with R on every day but one. Fair weather again on 21st, though the last week was dull and misty. Duration of sunshine 43·7* hours, or 4·1 hours above the average. Mean temp. 39°·5, or 1°·8 above the average. An aurora of unusual brilliancy was seen on 10th.

SOUTHPORT.—Extremely sunny, the total duration being 98·2* hours, or 29·6 hours above the average. The mean temp., 37°·2, was 1°·8 below the average, the weather being very cold till 8th. R ·36 in. below the average; duration 28·5 hours. Water levels were considerably lower than usual.

CARMARTHEN.—Very cold and dry, water supplies becoming low. Frost prevented fruit trees from budding too early, thus improving the prospect of fruit.

HAVERFORDWEST.—Cold and changeable, with small R. Severe gale on 19th, 20th aud 21st. Fine aurora on 9th. Duration of sunshine 86·4* hours.

DOUGLAS.—Wintry with much, but not severe, frost. The first two and the fourth weeks had considerably below the average temp., but the third was wet and mild, with violent westerly gales and high seas on 19th and 20th. The R was below the average and the land where properly watered was in excellent condition.

DUMFRIES.—The early part was marked by low temp. and constant S showers. An aurora borealis of exceptional brilliancy on 9th ushered in a change to almost continuous R for 10 days. Vegetation was late and farm work in arrears.

COUPAR ANGUS.—The mean temp., 35°·8, was about the average, but the month was noteworthy for the long period of severe frost and drifting S. A welcome change to mild weather set in at the close.

BLAIR ATHOLL.—S lay on the ground for 29 days from January 24th, and continuous feeding of hill stock was necessary in the neighbourhood.

DRUMNADROCHIT.—R ·05 in. below, and rain days equal to, the average of 21 years. The month was notable for gales and S and for the fine display of aurora borealis on 9th.

WATERFORD.—R 1·15 in. below the average. Mean temp. 39°·9.

DUBLIN.—A cold month, the mean temp. being 40°·3, or 2°·2 below the average. At first quiet anticyclonic weather, followed by a warm period from 13th to 19th and then a very cold spell. Overcast, quiet and anticyclonic from 22nd to the close. Stormy from 16th to 20th. Fine aurora borealis on 9th.

* Campbell-Stokes.

Climatological Table for the British Empire, September, 1906.

STATIONS. (*Those in italics are South of the Equator.*)	Absolute. Maximum. Temp.	Date.	Absolute. Minimum. Temp.	Date.	Average. Max.	Min.	Dew Point.	Humidity.	Absolute. Max. in Sun.	Min. on Grass.	Total Rain. Depth.	Days.	Aver Cloud.
	°		°		°	°	°	0-100	°	°	inches		
London, Camden Square	94·0	2	39·0	28	70·5	50·6	52·4	78	131·5	35·4	1·75	8	...
Malta	...	...	...	...	...	...	...	...	...	...	..	...	...
Lagos	86·0	13*a*	71·0	18*b*	83·3	73·3	72·1	79	141·0	69·0	1·67	15	8·0
Cape Town	74·1	21	38·3	2	63·6	48·9	47·9	73	...	...	·99	7	3·7
Durban, Natal	80·4	15	54·4	26*c*	74·0	59·1	...	...	137·4	...	3·84	13	4·7
Johannesburg	79·5	16	35·0	26	70·7	48·3	46·0	68	143·8	30·0	·51	2	2·7
Mauritius	79·9	30	54·1	25	75·5	61·2	58·4	73	148·7	46·3	1·73	18	5·7
Calcutta	92·4	1, 21	75·4	12	87·7	78·6	77·9	87	157·0	74·8	8·30	13	8·5
Bombay	87·5	20	75·4	21	85·1	77·3	74·9	82	137·0	71·8	3·94	18	6·4
Madras	99·4	13	72·3	20	92·9	77·5	74·6	78	147·9	72·3	6·27	14	5·9
Kodaikanal	67·1	30	47·6	29	62·8	51·4	50·4	81	141·2	37·2	4·93	16	6·3
Colombo, Ceylon	88·4	29	74·8	29	87·1	78·5	72·8	77	150·2	73·5	·05	2	6·3
Hongkong	90·3	28	73·4	12	85·3	77·0	74·2	80	146·5	...	30·60	21	7·0
Melbourne	76·1	26	36·0	7	52·6	48·8	45·0	76	139·2	28·8	3·84	8	6·7
Adelaide	77·2	25	36·9	6	64·8	47·5	46·9	71	136·4	55·1	3·37	15	5·8
Coolgardie	79·0	28	33·2	16	67·0	43·5	39·9	57	145·4	30·0	·16	3	4·4
Sydney	70·0	6, 27	44·1	16	64·5	51·4	49·1	74	111·5	36·2	1·36	25	5·9
Wellington	61·1	16	38·5	6	55·1	42·2	41·7	74	130·0	30·0	3·04	15	6·0
Auckland	64·0	28	43·0	12	58·9	48·1	45·2	74	128·0	36·0	4·32	14	6·3
Jamaica, Negril Point	92·9	19	70·6	29	87·8	74·0	75·0	79	...	...	4·46	9	...
Trinidad	92·0	11	68·0	20	89·1	71·3	74·0	85	161·0	68·0	6·54	20	...
Grenada	88·4	16	73·4	23	86·0	76·3	73·3	78	150·0	...	4·27	14	3·0
Toronto	90·4	9	41·7	25	75·2	54·5	56·7	75	116·5	36·2	...	...	2·9
Winnipeg	99·0	7	31·0	27	74·7	46·9	...	...	...	...	1·51	8	4·7
St. John's, N.B.	76·0	19	39·8	25	62·7	50·3	...	...	...	...	1·91	11	4·7
Victoria, B.C.	71·7	1	42·2	11	63·3	49·6	...	83	...	...	3·14	11	6·4
Dawson	68·0	1	15·0	28	55·0	31·7	...	...	...	...	1·14	8	5·8

a and 14. *b* and 21. *c* and 27.

Johannesburg.—First TS of the season on the 18th, absolute drought lasted 123 days.

Mauritius.—Mean temp. of air 1°·9, dew point 1°·8, below, and R ·33 in. above average. Mean hourly velocity of wind 10·4 miles, or 1·6 below average.

KODAIKANAL.—Bright sunshine 134 hours.

COLOMBO.—Mean temp. of air 82°·4, or 1°·5 above, of dew point 0°·5 below, and R 5·00 in. below, averages. Mean hourly velocity of wind 9·7 miles.

HONGKONG.—Mean temp. of air 81°·0. Bright sunshine 171·2 hours, or 30 hours below average. R 22·38 in. above average. Mean hourly velocity of wind 16·7 miles, or 4·9 above average. Gales on 18th, 20th, and 29th.

Adelaide.—Mean temp. of air 0°·8 below, and R 1·66 in. above, averages. One of the wettest Septembers on record. Sunshine 19 hours below average.

Coolgardie.—Mean temp. of air 3°·1, and R ·62 in. below averages of 13 years.

Sydney.—Mean temp. of air 0°·8 below, and R 1·56 in. below, averages.

Wellington.—Mean temp. of air 1°·9 below, and R 1·48 in. below, averages.

TRINIDAD.—R ·89 in. below 43 years average.